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Montana Science & Technology Alliance

1991 BIENNIAL REPORT

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Montana Science & Technology Alliance
1991
Biennial Report

Submitted to:

Stan Stephens, Governor
State of Montana
And
The Fifty-Second Montana Legislature

Department of Commerce
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PLEASE RETURN

January 7, 1991

The Honorable Stan Stephens
Governor
State of Montana
Helena, Montana 59620

Dear Governor Stephens:

With re-enactment in 1989, the Montana Science and Technology Alliance has recommitted itself to the goal of stimulating the technology-based entrepreneurial capabilities of Montana's economy. The partnership between the business community, the university system, and government, forged during earlier investments, continues to be strengthened.

During this biennium, over $1.2 million from the Seed Capital Financing Program, matched with $1.2 million in private funds, was invested in early-stage companies while $400,000 from the Research and Development Financing Program, matched on a dollar-for-dollar basis, was committed to the Centers of Excellence. Through these recent investments, MSTA has fostered the commercialization of innovative technologies and research capabilities in the fields of laser materials, computer software, biotechnology, hazardous waste remediation, and entrepreneurship. The complementary nature of these two programs works for the benefit of all facets of Montana's economy.

The Board is confident that appropriate legislation can be adopted during the 52nd Montana Legislature to provide expanded funding for the research and development program. Through the work of the recently-created Montana Science and Technology Advisory Council, we expect to move Montana and its science and technology development forward into the 1990s and the twenty-first century. The analysis and recommendations of the Council's in-depth audit of the state's strengths and capabilities in science and technology development will be presented to you next summer in a comprehensive Montana Science and Technology Plan.

It is with sincere thanks for your continuing support and a sense of optimism for Montana's future that the Board of Science and Technology Development transmits this 1991 Biennial Report.

Sincerely,

Chase T. Hibbard
Chase T. Hibbard
Helena

Annie M. Bartos
Annie M. Bartos
Helena

Tom Breum
Tom Breum
Bonner

John C. Brower
John C. Brower, Ph..D.
Butte

Dixie Halverson
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Introduction

MSTA financing programs re-enacted

On March 24, 1989, Governor Stan Stephens signed into law House Bill 683, the Montana Science and Technology Financing Act. Adoption of the bill put the financing programs of MSTA back in business after the Montana Supreme Court decision struck down the agency's seed capital bond program in July 1988.

The legislation, requested by Governor Stephens and sponsored by Representative Bob Marks of Clancy, passed the Montana House of Representatives by a vote of 98-0 and the Montana Senate by a vote of 46-3. The act addresses the constitutional defects identified by the Montana Supreme Court in the White decision by avoiding the use of bond proceeds, thereby not pledging the credit of the state against private debt. It specifically defines the bounds of authority granted to MSTA for its use of state funds. The act also created the nine-member Montana Board of Science and Technology Development. Its members are appointed by the Governor while the Alliance is staffed by the Montana Department of Commerce.

Members of the Montana Board of Science and Technology Development, left to right, Tom Breum, Chairman Chase T. Hibbard, Annie M. Bartos, and Jon Marchi; seated left to right, John C. Brower, Sue Matthews, and Ken Thuerbach (absent members are Dixie Halverson and Ray V. Tilman)

The legislation gives MSTA five-year management authority over $7.5 million of the In-State Investment Fund, a portion of the Coal Severance Tax Trust, to fund the seed capital financing program. MSTA uses the funds to participate in financing new and expanding technology-based, Montana businesses that its board determines meet statutory investment criteria. These statutory criteria are modeled to closely reflect private venture capital practices.

Passage of HB683 also re-established operating procedures for the research and development financing program. MSTA provided $400,000 in appropriated funds for continuing the state's technology centers of excellence program initially funded in 1988. The centers program has potential to build Montana's applied research infrastructure and to stimulate the flow of commercial opportunities for MSTA and other investors.

The purpose of MSTA's financing programs is to encourage innovative scientific and technological development within the state in the expectation of advancing the state's economic growth and welfare. As such, it is intended to aid in the creation of new jobs and to assist in financing the establishment of technology-intensive businesses in Montana.

Financing Programs

The MSTA has two complementary financing programs, the seed capital financing program and the research and development financing program.

The MSTA's seed capital financing program provides venture capital style financing for technology-based companies that have outstanding technological and commercial potential for achieving significant growth. The statutory 1:1 matching funds requirement encourages the participation of private investors. The seed capital program also attempts to provide a liaison between entrepreneurial companies in Montana and private investors in an effort to enhance the pool of capital available to the state's technology-based companies. The successful companies will benefit the state's economy and provide a substantial return on investment to the MSTA.

The goal of the research and development financing program is to assist in the accelerated development of technology in the state. Since re-enactment, the MSTA has committed its limited appropriated research and development funds to continuing its centers of excellence program established in 1988. The centers draw on the research strengths of the Montana University System, include the active participation of the private sector, and provide financing to selected later stage applied research projects involving a private company as the potential commercializing partner for the resultant technology. Thus, the research and development program is an opportunity for Montana to enhance its research capabilities and to encourage the linkage between the university system and private companies that will result in the commercialization of new technologies in Montana.

Financing Criteria

The MSTA, through its seed capital and research and development financing programs, gives priority to projects which incorporate advanced or innovative technologies and include plans for full product commercialization.

In its seed capital financing program, the MSTA funding criteria are similar to those of the private seed capital investment community. Typically, such investors look to invest in a company at an early stage or before it has achieved significant sales, but has the prospect of achieving significant sales within five to seven years. While MSTA's return requirements are not as stringent as those of venture investors, they are modeled to closely reflect private venture capital practices.

The criteria for the MSTA research and development financing program take advantage of the existing research and development strengths within the state's university system and private sector establishments, stress the potential to add value to a basic industry sector of Montana's economy, and employ a collaborative approach involving both public-private and inter-university cooperation.

Seed capital and research & development financing programs provide funds for innovative, technology-based development in Montana

Financing Process

All applications for financing by the Alliance, both in seed capital and research and development, are subjected to a rigorous review process.

In the seed capital financing program, each business plan presented to MSTA is subjected to a demanding and thorough evaluation of its investment potential. The initial or threshold evaluation focuses on the technology, the market potential of the company, the quality of the company's business plan and the company's management team. If the initial review results are positive, the MSTA then conducts an in-depth due diligence evaluation of the company's management team and investors, potential customers and suppliers, competition, technology, and market potential.

Applications for research and development financing are also subjected to a thorough evaluation. The review process focuses on the technological feasibility of the project design and implementation, the technical competence of the investigators and the project's prospects for eventual commercial success.

The MSTA board meets regularly and provides funding support on a selective basis to projects that it determines satisfy MSTA's financing criteria. All financings require operations to be based in Montana and provide for a specified return on investment to MSTA. The rigor imposed by the evaluation process tests the technical feasibility and commercial viability of each project and helps build a foundation for a higher probability of success for funded projects.

The rigorous evaluation process builds a foundation for a higher probability of success for funded projects

Return on Investment

The MSTA is required by statute to seek returns on both its seed capital and research and development financings.

The seed capital program provides venture capital style financing through a mechanism that can be flexible enough to forego short term repayment requirements and that provides MSTA with high return-on-investment potential. Financings are structured as loans with the interest rate set at 10.5 percent. Debt service is generally deferred until maturity of the loan, allowing the company to use funds usually reserved for short term repayments to meet cash flow needs.

Also included in the seed capital loan agreement are features providing for convertibility or for a warrant which allow the holder to own shares of company stock. In the case of a convertibility feature, the company would issue a debenture to MSTA commensurate with the amount of the MSTA investment, pegged to the company's valuation and backed by shares of the company's stock. MSTA can either sell the debenture at any time or collect the debt from the company at maturity according to the established interest rate. In the case of a warrant, the company would issue an instrument that would give the holder the right to purchase common stock of the company at a specific price within a given amount of time.

MSTA is prohibited by the Montana Constitution from holding equity shares in a company. Purchasers of MSTA's debentures or warrants are able to convert or exercise, thereby becoming direct equity holders. As the company becomes more successful, with increasing stock value, the market price of the debenture or warrant is expected to rise accordingly, and MSTA hopes to maximize its return from successful investments. Upon sale of the financing instrument, all obligations owing to MSTA by the company are deemed satisfied.

In the research and development program, financings are structured as loans and require a return on investment. Typically, the return is paid to MSTA annually as a percentage of any income stream derived from the commercialization of the resultant technology until MSTA has received two times its investment. Some research and development projects involve indirect return related to MSTA's goals.

Program Results

During the 1991 biennium, MSTA closed on eight technology development financings totalling $1,605,750 in both the seed capital and research and development areas. The funds were matched with $1,645,750 for a total of $3,251,500 committed to technology development in Montana during the 1991 biennium. Since April of 1989, MSTA answered 172 funding inquiries which resulted in 92 proposals being submitted in response to MSTA's application process.

In its seed capital financing program, MSTA has placed investments in four companies totalling $1,205,750. These funds were matched with $1,245,750 and bring the total funds expended under the seed capital program to $2,451,500 since re-enactment in 1989. If successful, the four seed capital portfolio companies could realize over $64 million in annual revenues and create almost 240 new jobs in Montana by 1996.

In the research and development program, MSTA provided continued support for its Centers of Excellence program through financing commitments totalling $400,000 in four centers. These funds, matched on a dollar-for-dollar basis, bring the total funds committed through this program to $800,000 for the 1991 biennium.

Also during the biennium, MSTA hosted the Montana Technology and Entrepreneurship Forum. Sponsored by the Montana Private Capital Network and the Billings Chamber of Commerce, the forum was attended by over 100 participants and showcased 25 technology-based companies and research organizations. The forum linked investors from throughout the nation, leaders in entrepreneurial and technological development from both business and government, representatives from public and private research organizations and officials from federal research-sponsoring agencies. The forum raised the participants' awareness of the technology development capabilities available within Montana.

Since 1985, MSTA has placed technology financings totalling $4,566,079 in 44 projects in both seed capital and research and development areas. These funds have been matched with $7,814,280 for a total of $12,380,359 being expended to stimulate technology-based entrepreneurial development and enhance the research capabilities for the benefit of Montana's economy.

The Montana
Technology and
Entrepreneurship
Forum

Since re-enactment in 1989, over $3.2 million has been invested in technology development through MSTA

Future Program Directions

Montana Science and Technology Plan

As part of the process to move Montana and its science and technology development forward into the 1990s and the twenty-first century, the Governor issued executive order 13-90 creating the Montana Science and Technology Advisory Council on October 22, 1990. The council is established under the provisions of the Montana Science and Technology Financing Act enacted in 1989.

Governor Stan Stephens signing the executive order creating the Montana Science and Technology Advisory Council. Also present, left to right, are Acting Deputy Commissioner for Academic Affairs David Toppen, MSTA Board Member Jon Marchi, MSTA Board and Council Member John Brower, MSTA Board Member Annie Bartos and MSTA Executive Director Carl E. Russell

The purpose of the council is twofold. First, to develop and recommend a state science and technology plan to MSTA board. After approval by the board, the plan will be presented to the Governor. And, second, to the review and comment to MSTA on specific applications for research and development projects.

The council held its initial meeting in November in Helena. Subsequent meetings and public hearings will be held in the coming months in Helena, Bozeman and Missoula to gather input from all Montanans. Specifically, the plan developed by the council will include: a science and technology development policy; an identification of the strengths and weaknesses in the basic science resources and research capabilities in the state; a research agenda designating areas for potential scientific and technological development; a plan to encourage basic science research and strengthen Montana's efforts in applied science; recommendations on how to strengthen the partnership between the private sector, university community and government for science and technological development and financing; recommendations on how to improve and sustain the infrastructure for research and research training; and recommendations on how to achieve research excellence.

To implement the recommendations of the council in its science and technology plan, MSTA will seek legislative support for expanded MSTA research and development program financing for the 1993 biennium. The proposed legislation may provide funds to the National Science Foundation-designated Center for Interfacial Microbial Process Engineering at Montana State University and to the National Science Foundation's EPSCOR research program to enable both programs to meet federal matching funds requirements. In addition, the legislation may provide funds for other research and development initiatives including continued funding support for the MSTA centers of excellence program. The MSTA's research and development funding decisions during the 1993 biennium will be based on council's recommendations contained in the state science and technology plan.

During the 1991 biennium, the MSTA research and development program focused on providing support for its research centers of excellence in cooperation with the units of the university system and private sector companies. The MSTA-supported centers are the Center of Excellence in Biotechnology involving the University of Montana and Montana State University; Advanced Minerals and Hazardous Waste Processing Center of Excellence involving the Montana College of Mineral Science and Technology, Montana State University and the University of Montana; the Center for Interfacial Microbial Process Engineering involving Montana State University and the Idaho National Engineering Laboratory and the center's numerous industrial sponsors; and the Montana Entrepreneurship Center involving the University of Montana, Montana State University and Eastern Montana College.

The MSTA anticipates that efforts of the Montana Science and Technology Advisory Council and subsequent implementation of the council's comprehensive science and technology plan will guide Montana's efforts in technology development into the 1990s and beyond.

Montana Science and Technology Advisory Council

Robert E. Ivy, Chairman of the Council
President and CEO
Ribi ImmunoChem Research, Inc.
Hamilton, Montana

John C. Brower, Ph.D.
MSTA Board Member and
Professor of Business
Montana College of Mineral Science
and Technology

Walter E. Hill, Ph.D.
Professor of Biochemistry
Director of Center of Excellence in
Biotechnology
University of Montana

Richard K. Quisenberry, Ph.D.
Vice President and Research Director
The DuPont Company
Wilmington, Delaware

Carl E. Russell
Executive Director
Montana Science and Technology Alliance

Clarence A. Speer, Ph.D.
Professor and Head of Veterinary
Molecular Biology
Montana State University

David Toppen, Ph.D.
Acting Deputy Commissioner for
Academic Affairs
Montana University System

Larry G. Twidwell, Ph.D.
Professor of Metallurgical Engineering
Montana College of Mineral Science
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Gerald Wheeler, Ph.D.
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Montana State University

William R. Wiley, Ph.D.
Senior Vice President
Battelle Memorial Institute and
Director of Pacific Northwest Laboratories
of the Department of Energy
Richland, Washington

Bud Wonsiewicz, Ph.D.
Vice President Science and Technology
U S WEST Advanced Technologies, Inc.
Englewood, Colorado

Small Business Innovation Research Program

In an attempt to secure additional research funds for Montana companies, MSTA serves as the state's liaison for the federal Small Business Innovation Research program. Since inception of the program in 1982, Montana companies have received a limited number of SBIR awards. Accordingly, MSTA will provide pertinent information on SBIR program solicitations and application procedures to Montana companies.

Under this program, agencies of the federal government are required to set aside a portion of their research budget to fund research conducted by small firms on specific topics that have commercial potential. Competitive awards in the form of grants are made over several phases. Phase I awards are for up to $50,000 to evaluate the scientific and technical merit and feasibility of an idea. Phase II awards are for up to $500,000 for full-scale research and development of the proposed idea. During Phase III, an innovation is brought to market by private sector investment and support. While no federal SBIR funds may be used in Phase III, this phase may involve follow-on production contracts with a federal agency for future use by the federal government or investment by MSTA or private investors to commercialize the technology.

Through MSTA's proactive effort, Montana companies may receive an increasing number of SBIR awards. The SBIR funds to support these commercially-viable research and development activities will strengthen the companies' competitiveness for the benefit of Montana's economy.

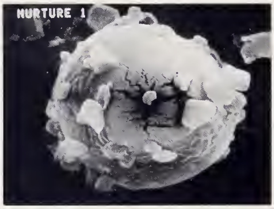
MSTA's proactive effort on behalf of Montana companies may result in their receiving an increased number of SBIR awards

MSTA Seed Capital Portfolio Companies

Basic Bio Systems, Inc.

In August of 1989, MSTA placed a $350,000 investment in Basic Bio Systems. The company committed to provide $350,000 in matching funds. As a result of MSTA's investment, the company expanded its research facilities and its cooperative research relationship with the University of Montana, Montana State University and the National Institutes of Health's Rocky Mountain Laboratory in Hamilton, Montana.

The Missoula-based company is focusing on cosmetic and over-the-counter pharmaceutical products for its initial markets. The NURTURE system, the company's proprietary technology, utilizes oat-based protein microparticles for the controlled delivery of a variety of substances. The company has filed four patent applications covering its technology. Formulations containing NURTURE prolong the efficacy, reduce the amount, or control the dosage of these ingredients. NURTURE lends itself to incorporation in both solid and liquid formulations, can be applied topically as powders, lotions, or sprays, and is biodegradable and non-toxic.



Above Right: Basic Bio Systems' NURTURE microparticle prior to formulation. Size is comparable to a red blood cell.
Above: Biochemist Steve Bixby and Chemist Maria Essig investigating oil slick dispersal with NURTURE.

The company has entered into product development agreements with domestic and foreign companies for specific applications of the NURTURE system in pesticides, personal care products, food flavor concentrates, personal care products, animal health care products, and cosmetics. The U.S. Environmental Protection Agency has given the company approval for sale of NURTURE as a pesticide adjuvant. Considerable interest has been shown by major oil companies and government entities in the ability of NURTURE to emulsify and disperse oil spills in the marine environment.

Dr. Bruce Vorhauer is chairman of the company's board of directors and acting president and Dr. Richard Potter is vice president for research and development. Dr. Vorhauer founded VLI, which commercialized the Today contraceptive sponge. Dr. Potter was instrumental in developing controlled-release technologies for Shell's No-Pest Strip and Hartz Mountain Flea Collar. Joining Dr. Vorhauer on the company's board of directors are Dr. Kashmiri Gupta, an expert in controlled-release technology, Dr. Alan Cameron and Ms. Helen Cameron, early investors, and Carl Russell, MSTA executive director.

The company is currently raising first round financing of $1.5 million to build a small production facility in Missoula. A $3 million second round of financing is scheduled to be in place by mid-1992. Major expansion of the company's production facilities are expected in Missoula as additional financing is achieved.

While currently employing four, if successful, Basic Bio Systems expects to achieve annual revenues of $35 million and create 67 new jobs in Missoula by 1996.

ChromatoChem, Inc.

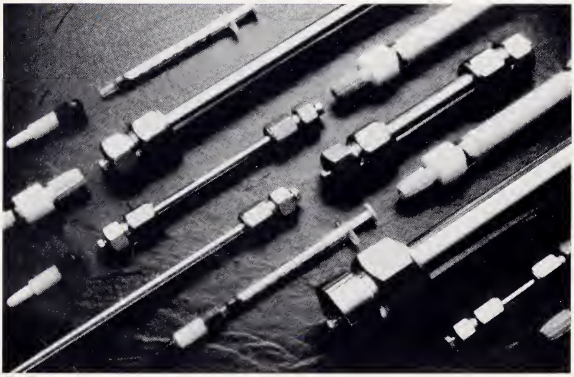
MSTA closed on a $350,000 investment in ChromatoChem in December of 1989. The company provided $350,000 in matching funds. Part of the MSTA investment was used to restructure the company's previous debt to the Alliance. The company was MSTA's first funding recipient in 1986. At that time, Dr. Richard Hammen, the company's founder, relocated the company from California to Missoula. The remainder of the investment was used for company development in anticipation of launching a private venture capital fund-raising program in 1991. This will supplement the $1.2 million in equity capital raised to date by the company.

The company's technology centers around "affinity chromatography," a separations process where certain molecules attach themselves to other molecules in order to trap the desired products. This process increases the yield for purifying biopharmaceuticals produced by genetic engineering and cell culture. It can also be used for routine quantitative chemical analysis and blood filtration. This technology enables scientists to perform high resolution affinity chromatography in a fraction of the time it previously took to carry out an affinity separation using currently available media. The company's technology is the subject of a patent filed in June of 1987.

The company is developing new applications for its "affinity chromatography" technology. First, the company is looking to expand into the water treatment industry. The company is a partner in a research project, funded through the Minerals and Hazardous Wastes Processing Center of Excellence at Montana Tech, to utilize its technology for possible remediation of the Berkeley Pit water. Second, the company recently entered into an agreement with Champion International Corporation for extraction of a food additive from wood chips. If successful, ChromatoChem's process would create a new value added product from the forestry industry. Third, the company has entered into a long term research and development contract with a Japanese ceramics insulator and wastewater treatment firm expanding into the biotechnology field.

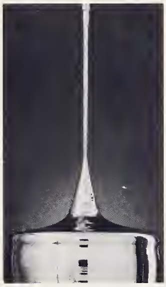
The company's board of directors includes Dr. Hammen, Dr. Robert Stevenson, a specialist in biotechnology and chemical separations fields, James Basolo, a Missoula businessman, Dr. Richard Callahan, president of the Idaho Research Foundation, and Carl Russell, MSTA executive director.

While currently employing eight, if successful, ChromatoChem expects to achieve annual revenues of $10 million and create 100 new jobs in Missoula by 1995.



ChromatoChem's affinity chromatography columns

Lattice Materials Corporation



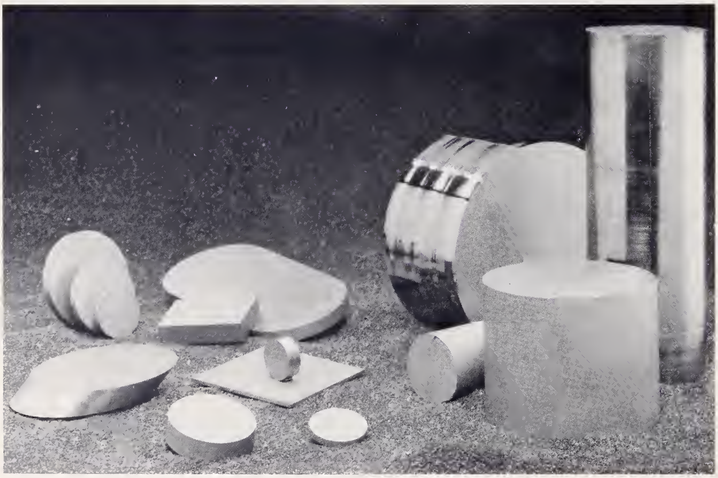
In September of 1990, MSTA closed on a second investment in Lattice Materials Corporation of Bozeman. Coupled with the earlier $210,000 investment in January 1990, the total MSTA investment in Lattice is $350,000. The MSTA funds were matched with $390,000 from a private stock issue and product sales. Also in 1990, the company was successful in receiving a $175,000 Community Development Block Grant from the city of Bozeman.

The MSTA funds were used by the company to hire additional personnel and expand marketing efforts for its crystal products. In addition, this enabled the company to meet production requirements of recently acquired contracts.

The company's initial market is silicon crystal optics for the infrared imaging and carbon dioxide laser market. Current products consist of two types of silicon crystals: first, reflective or mirror grade silicon crystals for the carbon dioxide lasers and, second, optical grade silicon crystal products for imaging systems. Market applications for carbon dioxide lasers include industrial cutting, welding and drilling operations, medical surgery, and military range finding and imaging. Since shipping its first product in the summer of 1989, the company continues to experience revenue growth.

John Tengelsen, the company's founder and president, relocated the company to Bozeman from Colorado Springs, Colorado, in early 1988. He has worldwide sales experience in the metallic crystal products industry. Joining Mr. Tengelsen on the company's board of directors are previous investor Gary Walton, Larry Johnson, president of Bozeman-based ILX Lightwave which manufactures electro-optical test instrumentation, Peter Hudson of Hughes Aircraft of California, and MSTA Executive Director Carl Russell.

While currently employing 13, if successful, Lattice expects to achieve annual revenues of $4.5 million and create 30 new jobs in Bozeman by 1994.



Top: Lattice Materials' silicon crystal upon completion of the growth process
Above: Lattice's silicon crystal products for use in carbon dioxide laser and imaging systems

Gateway Software Corporation

In May of 1990, MSTA closed on a second investment in Gateway Software Corporation. Coupled with the earlier $110,000 investment in February 1990, the total MSTA investment in Gateway is $155,750. MSTA funds were matched with $155,750 from product sales and commercial debt. In late 1990, the company was raising a $250,000 financing round. MSTA committed to invest $125,000 in this round if the company was successful in raising $125,000 from equity investors. The company is using the investment proceeds to increase its marketing and product development efforts.

The Billings company develops and markets software for school administration applications (K-12) for use on the IBM AS/400, a mid-range computer. The company's first independently-developed product is a library management system that allows libraries in a district to network. The company's library management software is installed on IBM AS/400 systems throughout the country with most recent installations in California and North Dakota.

Gateway and its president, John Robertson, have developed high quality software products and have an excellent reputation for product support and service. Mr. Robertson, both with Gateway and with his previous software company, have produced a number of software programs aimed at the school district market. A significant attribute of the investment opportunity is the large but specialized market niche addressed by Gateway's product line. Gateway is a designated IBM Business Partner. This provides Gateway with sales support of IBM's worldwide marketing network and commissions on sales of IBM products. Joining Mr. Robertson on the company's board of directors are Dr. Clyde Neu, an entrepreneur and member of the University of Montana's School of Business Administration and David Desch, a MSTA investments manager.

The company is currently developing additional products for the IBM AS/400 to complement its current library management system. In order to complete product development and initiate sales of its additional school administration products for the IBM AS/400, the company plans to raise a $525,000 equity financing round by 1992. MSTA may participate in this round if the company meets its business development and project sales milestones.

GATEWAY
SOFTWARE
CORPORATION

Gateway's library management software is installed on IBM AS/400 systems throughout the country

While currently employing seven, if successful, Gateway Software expects to achieve annual revenues of $15 million and create 40 new jobs in Billings by 1995.

Research and Development Centers of Excellence

Center of Excellence in Biotechnology

During the 1991 biennium, the board committed $125,000 in continued funding for the Center of Excellence in Biotechnology focused at the University of Montana in cooperation with Montana State University. Coupled with $200,000 of MSTA support provided in 1988, the MSTA provided $325,000, matched on a dollar-for-dollar basis, to the center.

The biotechnology center was created in 1988 as a distinct entity operated by the university but with funds administration handled by a governing board. Dr. Walter E. Hill is the center director. Members of the governing board include representatives from Skyland Scientific Services, ChromatoChem, Inc., Ribi ImmunoChem Research, Inc., Rocky Mountain Laboratory, the university units involved and MSTA. The governing board establishes policies, procedures, reviews proposals and oversees the activities of the director.

Top: A technician prepares a melanoma cell culture used in the manufacture of a cancer vaccine at Ribi ImmunoChem Research, one of the state's biotechnology companies active with the Center of Excellence in Biotechnology
Above: Center of Excellence in Biotechnology researcher viewing an audio radiogram at the University of Montana

Since initiating operations, the governing board has stimulated biotechnology research by providing funding to six projects. Topics under investigation include application of antibiotic features of plant defense systems to canola plants, monoclonal antibody technology to develop sensitive diagnostics for detection of neonatal diarrhea, electrophoresis/mass spectrometer interface for biochemical separations applications, software development for high performance liquid chromatography instrumentation, synthesis of peptides for use as therapeutic and test reagents, and identification of novel marine bacterial products for agrochemical and pharmaceutical applications. If commercialized, a return is paid to the center and MSTA.

Additional funding and technical assistance for these projects is being provided by the U.S. Department of Agriculture, the Washington Technology Center, Plantech Research Institute, Montana Agricultural Experiment Station, Tobacco Research Council, Montana's EPSCOR program, National Institutes of Health, and the Agrochemicals Group at Rohm & Haas Company.

The center also plays a significant role in increasing the awareness of the state's biotechnology activities. First, the center's annual biotechnology poster exchange conference links researchers with corporations with biotechnology research interests. Second, the center publishes a Montana bioscience research directory of investigators with expertise in the biomedical area. And third, the center maintains a database of all biotechnology concerns in the nation. Through its activities, the center is assisting the transfer of biotechnology information, expertise and ideas to the private sector for commercialization and the enhancement of Montana's biotechnology community.

Advanced Minerals and Hazardous Waste Processing Center of Excellence

During the 1991 biennium, MSTA committed $75,000 for continuation of the Advanced Minerals and Hazardous Waste Processing Center of Excellence focused at Montana College of Mineral Science and Technology. Combined with the $200,000 provided in the 1989 biennium, MSTA funding for the center totals $275,000 and is matched on a dollar-for-dollar basis.

As with other centers, this center was created as a distinct entity operated by the college but with funds administration handled by a governing board. Dr. Sam Worcester is the director of the center. Members of the governing board include representatives from Montana Technology Companies, Inc., Montana Hydroprocessing, Inc., Anaconda Minerals Corporation, the Montana Bureau of Mines and Geology, the university system, and MSTA. The governing board establishes policies, procedures, review proposals and oversees the activities of the director.

Since initiating operations, the governing board has provided funding to six projects. Topics under investigation include evaluating techniques for treating mine water from abandoned open-pit mines, evaluation of a portable, gravity concentration tub for mining applications, biohydrometallurgy for gold recovery, detoxification of acid mine drainage, and establishment of a Montana technology innovation center. Additional funding and technical support for these projects is being provided by Atlantic Richfield Company, Mycotech, Inc., ChromatoChem, Inc., EMS Labs, Montana Technology Companies, Inc., Steelhead Specialty Minerals, and the U.S. Environmental Protection Agency. If commercialized, a return is paid to the center and MSTA.

The center also plays a significant role in increasing awareness of the state's minerals and hazardous waste remediation activities. This past fall the center co-hosted the Mineral and Hazardous Waste Processing Symposium in Butte in conjunction with the Rocky Mountain Water Congress. The five-day symposium included presentation of technical papers, panel discussions on environmental concerns, opportunities for exchange of data and results of waste processing techniques and tours of several U.S. Environmental Protection Agency superfund sites. In addition, the center sponsored luncheon seminars, a guest lecturer, and participated in a national hazardous waste research conference in Kansas.

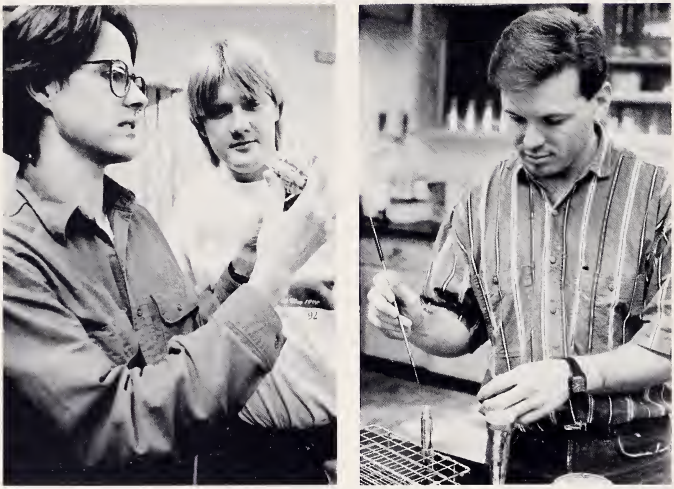
Through all of its outreach activities, the center is facilitating the transfer of minerals and hazardous wastes remediation technologies from the laboratory to the private sector.

Aerial view of the Berkeley Pit, subject of hazardous waste remediation research underway at the Advanced Minerals and Hazardous Waste Processing Center

Center for Interfacial Microbial Process Engineering

MSTA committed $50,000 on a matching funds basis to the Center for Interfacial Microbial Process Engineering at Montana State University upon its designation as a National Science Foundation engineering research center in early 1990.

The NSF centers, partnerships between academia, industry, NSF and the states involved, are dedicated to pursuing research that improves U.S. competitiveness. The Montana center is a partnership between Montana State University and the Idaho National Engineering Laboratory. Dr. William G. Characklis of Montana State University is the center director. In addition, the center includes research at Johns Hopkins University, Rensselaer Polytechnic Institute, the University of Idaho, the University of Wyoming and the Montana College of Mineral Science and Technology.



Two multi-disciplinary Ph.D. students from the Center for Interfacial Microbial Process Engineering discussing equipment design for an industrial application

Right: An engineer conducting microbial research at the center

Currently seventeen large corporations and industrial organizations, including Amoco Corporation, Dow Chemical, Electric Power Research Institute, Union Carbide, Montana Power Company, Weyerhaeuser Paper Company, DuPont, and Betz Industrial, are members of center's industrial associates program. This ongoing collaboration has resulted in research which these industries view as vital to improving their corporate as well as the country's competitiveness.

At the center, researchers investigate ways that microscopic organisms such as bacteria can be either a boon or bane to the efficiency of various industrial processes. Experts in microbiology, chemistry, chemical engineering and industrial processes probe the fundamental ways in which microbes grow on equipment surfaces and at the interfaces between gas, liquid and solid phases. The organisms and the products of the chemical reactions they carry out can contaminate, gum up or cause corrosion in operations such as oil refining, heating and cooling systems, fermentation, food processing, and microelectronics. The researchers also investigate microbial phenomena that can benefit industry. For example, bacteria are being studied for their potential to break down hazardous substances in contaminated soil and water and are increasingly being used to extract valuable minerals from low grade ores and mining wastes.

The NSF designation of the center greatly enhances Montana's research capabilities. Over the next five years, the $7.5 million in NSF funds, added to industrial and state support, could combine for a total of $15 million to $16 million being expended in the state through the center.

Montana Entrepreneurship Center

During the 1991 biennium, MSTA committed $150,000, matched dollar-for-dollar, to the Montana Entrepreneurship Center, a part of the MSTA center of excellence program. Financial support is also being provided by U S WEST Foundation and Atlantic Richfield Corporation. In 1988, MSTA provided initial funding for a planning study of Montana's entrepreneurial community.

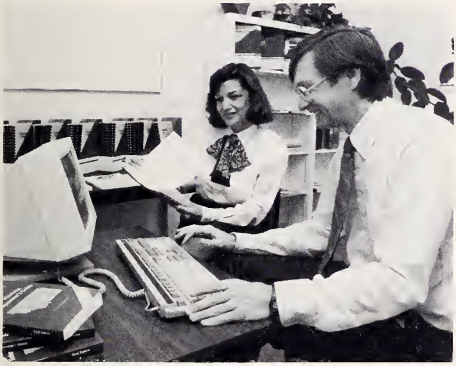
The center is a collaborative effort of the University of Montana's School of Business Administration, Montana State University's College of Business and Eastern Montana College's School of Business and Economics. Kay Lutz-Ritzheimer, executive director of the center, administers all statewide activities and serves clients at the central office in Missoula while Ann Keenan and Lori Morrin, directors of the Bozeman and Billings offices, respectively, serve clients throughout the state. Recognizing that the three campuses have unique facilities, expertise and programs, the directors at all three campuses work together to create a uniquely complementary package of services to address client needs.

The center links business owners and entrepreneurs with the information, resources and expertise they need to make their ventures operational. Center directors meet with clients to help them define and prioritize their needs. The directors then use the center's database of resources, programs, services, facilities, equipment and expertise found in the public sector, private sector, and university community to link clients with the resources required. The center also provides resource materials to help clients prepare business, marketing and financial plans.

The center's governing board serves as an oversight board to set policies and operating guidelines and to monitor operations. Members of the governing board include representatives from U S WEST Communications, ILX Lightwave Corporation, Alpine Log Homes, the oil exploration firm of Norsworthy and Reger, the university units and MSTA. In addition, each office has established an advisory board composed of local business leaders, entrepreneurs, public officials and university administrators to provide advice and guidance to directors at each location.

With future funding the center plans to establish electronic bulletin boards listing conferences, seminars and training programs scheduled statewide; to initiate computer conferencing systems networking business owners and entrepreneurs across the state and bringing expertise to the state where experience is lacking; and, in collaboration with MSTA, to implement a Montana private capital network linking entrepreneurs with the financial resources required for start-up, growth and expansion.

Serving as the gateway to the Montana university system and its unique resources, the center will make a critical difference for many new and developing businesses.



Left: Kay Lutz-Ritzheimer, executive director, and Bob Campbell, database manager, conduct a database search for a center client

Right: Directors for the Montana Entrepreneurship Center, left to right, are Kay Lutz-Ritzheimer, executive director, Ann Keenan, Bozeman director, and Lori Morrin, Billings director

Appendices

Statistical Analysis of Financing Activity

(April 1989 through November 1990)

Seed Capital Program

Inquiries	172
Investment Proposals	92
Investments Closed	4

MSTA Investments from Seed Capital Fund

MSTA Seed Capital Funds Invested	$	1,205,750
Matching Funds	$	1,245,750
Total Funds Invested	$	2,451,500

Research and Development Program

Investments Closed for Centers of Excellence		4
MSTA Research and Development Funds Committed	$	400,000
Matching Funds	$	400,000
Total Funds	$	800,000

Combined Seed Capital and Research and Development Programs

Total MSTA Funds	$	1,605,750
Matching Funds	$	1,645,750
Total Funds	$	3,251,500

Montana Science & Technology Alliance Financing Portfolio

Seed Capital Financings

April 1989 through November 1990

Company	Description	MSTA Funds	Matching Funds	Total Funds
Basic Bio Systems, Inc. Bruce W. Vorhauer, Ph.D. Missoula	Develop controlled release technology utilizing oat-based microparticles for a variety of substances in the initial markets of over-the-counter pharmaceuticals and cosmetics	$ 350,000	$ 350,000	$ 700,000
ChromatoChem, Inc. Richard F. Hammen, Ph.D. Missoula	Manufacture and sell high performance affinity chromatography products for the separation, purification and analysis of high value-added chemicals, biochemicals, and other liquid streams	$ 350,000	$ 350,000	$ 700,000
Lattice Materials Corp. John L. Tengelsen Bozeman	Manufacture and sell silicon metallic crystal optics for use in carbon dioxide lasers and infrared imaging systems	$ 350,000	$ 390,000	$ 740,000
Gateway Software Corp. John D. Robertson Billings	Develop and market K-12 school administration software for use on the IBM AS/400 mid-range computer	$ 155,750	$ 155,750	$ 311,500
Total Seed Capital Financing from April 1989 through November 1990		**$ 1,205,750**	**$1,245,750**	**$ 2,451,500**
	July 1985 through July 1988			
7 Portfolio Companies		$ 720,000	$ 3,630,871	$ 4,350,871
	July 1985 through November 1990			
Total Seed Capital Financings		**$ 1,925,750**	**$4,876,621**	**$ 6,802,371**

Montana Science & Technology Alliance Financing Portfolio

Research and Development Financings

April 1989 through November 1990

Project	Description	MSTA Funds	Matching Funds	Total Funds
Center of Excellence in Biotechnology Walter E. Hill University of Montana Missoula	The center will enhance the educational and research capabilities of the state's universities by building on existing university and private sector research and development strengths in biotechnology	$ 125,000	$ 125,000	$ 250,000
Advanced Minerals and Hazardous Waste Processing Center of Excellence Sam Worcester Montana College of Mineral Science and Technology Butte	The center will enhance the educational and research capabilities of the state's universities by building on existing university and private sector research and development strengths in minerals and hazardous waste remediation	$ 75,000	$ 75,000	$ 150,000
Center for Interfacial Microbial Process Engineering William G. Characklis Montana State University Bozeman	In partnership with the Idaho National Engineering Laboratory and the center's industrial associates, it will enhance the educational and research capabilities by building on existing university and private sector research and development strenghts in interfacial microbial process engineering	$ 50,000	$ 50,000	$ 100,000
Montana Entrepreneurship Center Kay Lutz-Ritzheimer University of Montana Missoula	The center will enhance the entrepreneurial assistance available to Montana entrepreneurs by proactively coordinating the strengths of the university system's three business schools	$ 150,000	$ 150,000	$ 300,000
Total Reasearch and Development Financings from April 1989 through November 1990		$ 400,000	$ 400,000	$ 800,000

July 1985 through August 1988

Project	Description	MSTA Funds	Matching Funds	Total Funds
29 Projects		$ 2,240,329	$ 2,537,659	$ 4,777,988
Total Research and Development Financings from July 1985 through November 1990		$ 2,640,329	$ 2,937,659	$ 5,577,988
GRAND TOTAL OF ALL SEED CAPITAL AND RESEARCH AND DEVELOPMENT FINANCING FROM JULY 1985 THROUGH NOVEMBER 1990		$ 4,566,079	$ 7,814,280	$ 12,380,359

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